NOTICE

**CERTAIN DATA
CONTAINED IN THIS
DOCUMENT MAY BE
DIFFICULT TO READ
IN MICROFICHE
PRODUCTS.**

DECLASSIFIED

Due to film deterioration,
portions of this document
may be illegible.

REL-11-91

Classification Cancelled (Change to

Declassified

By Authority of

CG-PK-2

SE Snyder 11-15-91

J. H. Kishner 11-21-91
PM Eck 11-21-91

- Copy #1 - J. E. Maider
2 - C. A. Priole
3 - H. A. Carlberg
4 - T. W. Hauff
5 - R. S. Bell
6 - O. V. Smiset
7 - C. P. Cabell
8 - R. T. Jessen
9 - C. F. Beaulieu
10 - A. P. Boston
11 - K. K. Campbell
12 - E. A. Foskett
13 - M. K. Harmon
14 - 300 File
15 - Yellow File

JAN 31 1992

This document consists of

- 11 Pages, No [redacted]

REDOX PLANT SHUTDOWN
January 8, 1955 to February 2, 1955

TO: R. S. Bell, Manager
Separations Section
Manufacturing Department

R. T. Jessen

- Superintendent
- Redox Plant Sub-Section
- Separations Section

RTJessen:BB:met

RECEIVED

JUL 9 1996

DECLASSIFIED

MASTER

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE

February 15, 1955

SUMMARY OF WORK ACCOMPLISHMENTS

The following work was completed during the Redox Plant shutdown in January:

1. Building Flush

Dissolver, metal solution storage and treatment tanks, columns, and plutonium bearing tanks were thoroughly flushed out preparatory to processing low MWD metal. Heels were removed from the dissolvers and a special HF-HNO₃ flush accomplished to remove silicon material which appeared to be causing the 1A column flooding at the time of the shutdown.

2. J-Cell

The condenser vent filter (J-6) was replaced and the off-gas diverted via the wind tunnel to the sand filter. This system was thought to contribute a significant amount of activity to the stack discharge in the past.

3. H-Cell

The very low vacuum in the metal solution oxidizer tank (H-4) had become a major problem at the time of the shutdown. Production rates were being restricted by the low boil up rates safely obtainable in H-4. In addition, a hazard existed to personnel caused from momentary pressurization of the tank during concentration periods.

In investigating and analyzing the cause of the poor vacuum, the following conditions were found to exist and the indicated steps taken to correct them.

- a. A leak existed in the flexible section of the H-4 to H-5 vapor line jumper. A new jumper was installed and leak tested. There was still a leak at the H-5 flange of the jumper where a stud bolt had been pulled out. This was rectified by the remote installation of a "C" clamp.
- b. A bad leak was observed around the tower flange on the H-4 pot.
- c. The H-4 tower appeared to be plugged, probably due to RuO₂ precipitated out in the tower packing during reflux operation.

February 15, 1955

Preliminary efforts to resolve the latter two problems were directed toward flushing out the tower while it was in place. A special jumper was fabricated to fit the top of the tower, and three flushes were made. This proved unsuccessful at clearing the obstruction as did water boil ups with reflux operation. It was decided that a new tower was mandatory. Prior to its being installed and to reduce the potential of plugging, a change in design was incorporated which substituted a sixteen inch chevron plate section for the packed section of the tower.

After installing a new tower and vapor line, the H-4 pot vacuum was greatly improved. Vacuum which approaches that which existed soon after startup is now possible in the oxidizer system.

The 25 gpm H-2 centrifuge to H-4 oxidizer jet was replaced with a 10 gpm jet to minimize pressurizing of H-4 during cake wash. No upset of H-4 vacuum was noted during the first cake wash utilizing the new jet.

A new H-6 off-gas thermohm which included a cross tie between the condensate outlet and the condenser shell, was installed.

3. Paralleling Facilities

A beginning was made on providing parallel facilities for as much of the critical building equipment as possible. This work is in line with the long range goal of reducing downtime to a minimum. The following facilities were installed during the shutdown:

- a. The F-3 tank was readied for use as a feed tank for the 1S column. This entailed installation of a new pump and a feed valve-rotameter assembly. The 1A column letdown valve was placed in the 1SW position and a new valve with a larger trim placed in the 1AW position. This provides the large valve in the preferential operating position. A new F-8 to F-7 jet was installed to permit flexibility in transferring feed between the two column feed tanks.
- b. A specially designed G-5 to H-2 (centrifuge feed) jet assembly was installed. This assembly contains two jets with control valves so placed that either jet may be back flushed while the other is in use.

4. Equipment For Increasing Capacity

Certain pieces of equipment were limiting capacity at a nine tons uranium per day rate. A number of these were replaced during this shutdown:

DECLASSIFIED

February 15, 1955

- a. A new 2A column feed valve - rotameter assembly was installed.
- b. A new 2E column letdown valve was put in place.
- c. Both the F-2 (First uranium cycle concentrator) and the G-3 (organic still) pot trap jumpers were removed and the traps readjusted to permit greater condensate flows.
- d. The G-1 to O-1 (organic surge tank to organic treatment building, 276-S) pump appeared to be approaching the limit of its capacity at a nine tons uranium per day rate. It was planned to install a higher capacity pump with a shorter shaft which would permit the buildup of a water heel in the bottom of the G-1 tank. A jet was to be installed in G-1 to permit jetting this heel to the G-3 organic still. By this means, the amount of water in the hexone (and the amount of radioactivity, since the water carries most of the activity) sent out to the 276-S building would be greatly reduced. However, due to faulty instructions to the shop, the wrong type pump was revised for this service. As a result, when installed, it failed to give the capacity required. This necessitated replacing it with the original pump and postponing the G-1 to G-3 jet installation.
- e. 804 Tank Pumps - Higher speed motors were installed on the organic head tank pumps to provide more capacity. The former pumps appeared to have reached their limit a nine ton uranium per day rate.

5. G-3 Leak Repair

Definite plans had been made to repair the leak in the G-3 pot which not only was creating a water disposal problem, but also was limiting the capacity of the still. Inspection revealed that four studs (out of eight) were broken off or pulled out of the right tube bundle flange and two from the left flange. In an effort to stop the leaks, remotely installed "C" clamps were placed on the flanges where the studs were missing. This method was successful in stopping (almost completely) the leakage around the right hand tube bundle. It was ineffective for the left one, however. For this flange a remotely placed gasket was designed and installed with a new tube bundle obtained from the D-12 spare. The original remote gasket design was not adequate to stop the leakage, and a new "O" ring type had to be fabricated and installed. With this gasket and one "C" clamp, the leak on the left hand tube flange was practically stopped.

6. D-12 Waste Concentrator

The leak in the D-12 pot coil became so bad that a replacement was necessary. Since it was necessary to use a tube bundle from the

Phase II D-12 in G cell, this pot could not be installed during the shutdown. Pot #5, a spare of the original design, was installed.

7. Silver Reactors

All three silver reactors were regenerated since the amount of metal processed through them was approaching the maximum permissible under the periodic regeneration program. Some trouble occurred with plugging of the B-3 reactor, but was apparently cleared by heating the tower.

8. E-7 Pump

The E-7 (cross oxidizer) to E-5 (2A feed tank) pump failed during flushing operations. It was replaced by a jet assembly.

9. Silo Change

- a. A new vent jumper was placed on the 3A column which also vented the 3AP overflow line thus minimizing air binding at accelerated rates.
- b. The manual valving in the 3DS jumper was reset to permit 3DS addition at a point approximately ten feet above the 3DF inlet manifold so that tests could be made of column performance with scrub introduced at this point (in preparation for precycle flowsheet).

ANALYSIS OF MAJOR DIFFICULTIES ENCOUNTERED

Problems Caused By Inability To Complete Work In Each Cell When It Was Entered

When making an over-all appraisal of the difficulties encountered during the shutdown, one outstanding fact stands out clearly:

There was an abnormally large amount of skipping around from cell to cell before the work in any one cell was completed. Every cell in the building was opened and some phase of the repair program carried out in it. The inability to completely finish the work in one cell before going to the next proved to be one of the greatest time consumers of the shutdown. Several times as many as three cells had to be opened, closed, and reopened during a single shift. Often this required shifting of equipment on deck, due to the very limited space for equipment storage in the Redox canyon, in addition to making large number of block moves necessary.

The causes for this inability to finish up the work in each cell consecutively as the shutdown progressed may be generally summed up as follows:

DECLASSIFIED

February 15, 1955

1. Inadequate Planning or Communication - In at least two instances, the wrong pieces of equipment were installed and had to be removed or reinstalled in a different place. The two instances of this were the G-1 pump case which was covered quite completely in the first section of the report and the LAW, LSW letdown valve mixup. In the latter case, it was necessary to install a letdown valve assembly in the empty LSW position. It was also desirable to increase the trim size in the LAW valve to give positive assurance of achieving the maximum possible rate through first cycle. A new valve assembly was made up having a larger valve, with the intention of placing it in the LAW position after the old LAW assembly was removed and inserted into the LSW position. Due to a misunderstanding, the new assembly was placed in the LSW position, and the cell had to be re-entered at a later date to correct this mistake.
2. Poor Fitting or "Damaged in Handling" Cell Equipment - In a number of individual jobs, new jumpers could not be installed due to poor fit or because jumpers were damaged while handling so that (in either case) the particular job involved had to be suspended until new jumpers could be provided. A certain amount of damage to jumpers must be expected and allowed for especially when they are removed or replaced several times. This is especially true of electrical connectors which require very little bending to be rendered inoperable. However, it is somewhat difficult to determine the reasons why jumpers cannot be installed when received from the shops. The following list indicates those jumpers or equipment pieces which failed to fit and required either new jumpers for replacements or special handling methods which deterred the progress of the job.

<u>Equipment Piece</u>	<u>Difficulty Encountered</u>	<u>Remarks</u>
1. P.F-8 Power Jumper	Bent from too much handling	New jumper required
2. LSF rotameter electrical	Would not make up properly	Repeated attempts at impacting finally permitted installation.
3. LSF control valve jumper	Leaking flange (from removing from LAF assembly - weak design)	New jumper required.
4. F-3 Thermohm	Unable to install	"
5. J-6 instrument line	Unable to install remotely	"
6. H-4 tower flusher	" " " "	"
7. 2AF rotameter electrical	Probably bent while handling	"
8. D-13 to D-12 "B" jet	Bent while handling	"
9. E-7 to E-5 jet steam line	Interfered with E-7 pump	Removed pump and put on a blank flange.

February 15, 1955

<u>Equipment Piece</u>	<u>Difficulty Encountered</u>	<u>Remarks</u>
10. H-5 pump discharge	Unable to install remotely	New jumper required
11. H-4 tower flange dowel pin holes	" " " "	Tower had to be decontaminated and dowel pin holes reamed out.
12. H-4 tower thimble (on which to set the old H-4 tower when removed)	Would not sit level on H-4 pot	Thimble jammed on base of tower
13. Silver reactor regenerating jumper	Damaged from excessive handling	New jumper required.
14. Initial G-3 tube bundle remotely installed gasket	No improvement from original	New design incorporating "O" ring gasket required complete seal.

Problems Created By A Lack Of Foreknowledge of Conditions To Be Encountered.

The second major source of difficulty encountered during this shutdown was the lack of knowledge prior to the date of the shutdown about the conditions which were going to be encountered in certain cells and what corrective steps would be necessary to effect repairs.

One example of this was the G-3 pot leak. It was known that a leak existed in the G-3 pot prior to the shutdown, but the lack of knowledge as to the cause made planning repair work difficult. When the leakage finally was definitely pin pointed to the tube bundle flange gaskets, the problem of the most economical and expeditious method of repair had to be faced in conjunction with the desirability of maintaining intact its spare, the Phase II D-12 pot, for installation in D cell. The poor condition of the tube bundle flange stud bolts came as somewhat of a surprise and certainly points up one of the glaring design weaknesses of this type of installation. A thorough review of the Phase II D-12 pot stud design is in progress by the Engineering Department.

It was originally anticipated that the G-3 tube bundles would be cool enough, radiation wise, to permit contact regasketing. This proved to be a naive assumption with readings up to 20 rads/hr being measured through the remote shop door with a tube bundle inside. A futile effort at decontaminating these tube bundles consumed valuable time, but it was considered worth the effort to explore all means of avoiding having to use a tube bundle from the Phase II D-12 pot. Use of remotely operable "C" clamps to replace the broken studs effectively stopped the leakage on the right hand tube bundle, but were of no value on the left bundle. It became apparent that a new gasket design which would provide a greater assurance of sealing the flange faces was an absolute necessity. It was felt advisable to design the gasket as a separate unit which could be replaced by itself if either the design was inadequate or the gasket failed in service at a later date. The use of this type gasket required the

DECLASSIFIED

February 15, 1955

use of a new tube bundle since the old bundle was too radioactive to permit removing the gage ring and old gasket from its flange. This plan stopped all thought of installing the Phase II D-12 pot during this shutdown, and efforts were immediately directed toward replacing the failed D-12 pot with the number 5, D-12 which had been repaired by blanking off one failed coil from the header.

A new type gasket was developed for G-3 (after one failure using a flat type gasket) which effectively stopped the leakage at the left tube bundle flange. This gasket consisted of a sheet of Teflon shaped into an "O" ring with the edges clamped between two thin strips of stainless steel. Thick walled neoprene tubing was inserted into the "O" ring (between the Teflon sheets) to provide body. The gasket is $\frac{5}{8}$ of an inch thick and fits in the recess of the flange formerly occupied by the gage ring. The gasket is compressed about $\frac{5}{32}$ of an inch before a metal seat is made while the design gasket could be compressed at most only $\frac{1}{32}$ of an inch providing all tolerances were carefully maintained during fabrication. One "C" clamp had to be placed on the left hand tube bundle along with this new style gasket to give an adequate seal.

The second example of running into unlooked for developments after the cell was opened, was H cell. While it was known that the H-4 pot vacuum was too low for safe operation, the exact source of the inleakage was indefinite. As events later proved, there were three major causes for the low H-4 vacuum.

The first of these was quite obvious on initial inspection. The H-4 to H-5 vapor jumper had a leak in the expansion section of the jumper. This was the second such leak to develop at this point in this type jumper within the past three months. This design weakness will be considered in conjunction with the possibility of redesigning the H-4 tower pending the result of some tests with the present H-4 tower during plant operations. This particular jumper will be set up in Spare Parts so that a replacement will always be available. A plugged tower and bad inleakage around the base of the tower were found to be the second and third sources of the poor H-4 vacuum which were not accurately pin pointed until the vapor line was repaired.

Prior to the shutdown, it had become evident that the H-4 was becoming partially restricted (as indicated by a rising differential pressure across the tower) probably as a result of RuO_2 being precipitated out during reflux operation and being held up in the tower packing. As a consequence, it was decided that the tower should be flushed three times using a series of 1.5% NaOH - 1% KMnO_4 and 15% HNO_3 - 3% H_2O_2 flushes. The pressure drop actually increased somewhat as a result of these flushes indicating probable loosening of the RuO_2 holdup in the tower. Backflow proved ineffective in reducing the pressure drop. A large leak was found to exist at the tower - pot flange which coupled with the high tower differential pressure made adequate boilup rates impossible. As a result, it was decided to install a new tower after first substituting four rows of chevron baffles in place of the packed section. It was necessary to discontinue the H cell work several days while the tower was readied.

February 15, 1955

Problem Created By Radiation Hazards

A major problem which was encountered during the shutdown was the large scale spread of contamination to the craneway and crane. The crane cab became contaminated and had to be evacuated several times due to high air conditions and once due to failure of the breathing air system pump. The crane, itself, and the craneway became so radioactive that crane maintenance became impossible.

The major contamination buildup came during H cell work especially while working on the H-4 tower. For the first time since the building began operations, it became apparent that the H-4 towers were so saturated with radioactive ruthenium that they have become thermally hot from the energy being released. Steam was observed coming out the tower flange of a supposedly cool piece of equipment when filling the H-4 pot with water. Steam was also observed coming from the old H-4 tower stored in J cell when hosing down this cell prior to maintenance work. Thus with such a thermally hot piece of equipment in the poorly ventilated Redox cells, thermal currents can carry radioactive ruthenium to the crane neutralizing the effect of the pre-cell work preparation of cooling the cell down six hours before entering.

All work in the cells was halted for a two day period and efforts were concentrated at removing some of the loose contamination. The canyon deck was hosed down twice and the crane sprayed off with solvent. Time limits for work on the bridge were still extremely short, but fortunately it was possible to finish the shutdown work without requiring any extensive crane repairs.

Problem Of Canyon Crane Failures

Prior to the large scale spread of contamination mentioned above, several crane outages lasting from three to ten hours occurred. Most of the crane trouble centered in the impact wrenches. The left hand wrench had to be replaced twice and its reelite cord replaced two times. The right hand wrench electrical cable was repaired twice, and the charging wrench replaced once during the shutdown. In addition the left hand auxiliary hook was replaced, the left hand wrench swivel bar was replaced, the 60 ton hook brake was repaired, and the right hand travel motor cable was fixed.

ANALYSIS OF IMPROVEMENTS MADE DURING THE SHUTDOWN

Despite the added length of the shutdown caused by the various problems encountered, it is felt that several necessary and worthwhile improvements were made to the building equipment. As a result of this shutdown, improved reliability of the plant operation and greater safety to personnel should be realized. These improvements are briefly summarized below.

DECLASSIFIED

DECLASSIFIED

HW-35201

February 15, 1955

1. Improvement which will provide greater operating reliability.
 - a. The completion of the equipment installation to permit running either 1A or 1S column independently of each other will lessen downtime caused by column flushes and first cycle pump failures.
 - b. The dual centrifuge feed jet assembly with provisions for back-flushing either jet independently should eliminate this source of production stoppage.
 - c. Replacement of the E-7 to E-5 pump with a jet assembly reduces by one the number of rotating pieces of equipment and thus improves operating reliability.
2. Improvements which provide adequate capacity for increased production rates.
 - a. The repairs effected to the oxidizer off-gas system have improved the vacuum in H-4 to the point that a 12 ton uranium per day production rate can now be obtained in H cell. Boil off rates of 200 gpm can now be achieved as compared to a rate of only 75 gpm before the shutdown.
 - b. The installation of a larger Purex type off-gas jet in the J-6 system as well as sealing up the leak at the D-12 pot tower flange by placing a 1/8 inch neoprene gasket on the pot flange before installation, has permitted achieving a vacuum of greater than 40 inches W.G. on the condenser vent system. This will permit higher boil up rates in the concentrators while still maintaining a vacuum on the system.
 - c. Several minor equipment changes covered in the first section of this report were also made. These included new: 2AF jumper, 2BU letdown valve, 1AW letdown valve, higher capacity organic feed pumps, and readjustment of F-2 and G-3 traps for higher capacity.
3. Improvements to original building design.
 - a. The new remotely installable tube bundle gasket for G-3 provides a radical change from the original building design gasket. Its application in this case prevented possible loss of a complete vessel. Future applications are being studied.
 - b. By tying in the vent line on the H-6 condenser condensate overflow line to the shell of the condenser, the inter-tie between the J-6 and J-3 vent systems has been eliminated and should provide smoother condenser operation.

February 15, 1955

- c. The new J-6 filter and discharge to the wind tunnel provides an increased safety factor over the former design by providing the added efficiency of filtration through the sand filter.

ANALYSIS OF BUILDING DESIGN DEFICIENCIES BROUGHT TO LIGHT BY THE SHUTDOWN

1. Broken Stud Problem

The inadequacy of the present stud bolt design was re-emphasized by the G-3 tube bundle difficulties. The stud bolts are not anchored in the flanges securely enough in some cases to withstand the normal treatment they receive from the impact wrench. In other cases the studs have become brittle due to internal stress caused by heat from welding them into the flanges, and break when subject to repeated impact stresses from the wrenches. The use of remote "C" clamps was proved feasible during this shutdown but cannot be considered more than a temporary solution to this problem. The Design Section has been requested to make a study of the whole stud bolt anchoring method and to offer recommendations for improvement.

2. Impossibility Of Preventing Contamination Spread

While not a new problem, the fact that the basic process and building design have caused a major problem of buildup of highly radioactive material in the head-end equipment and offer little assurance, making possible absolute control of contamination spread when performing cell maintenance on this equipment, was again re-emphasized. The necessity for pushing tail-end ozonization and removing equipment containing large quantities of ruthenium was again impressed on all concerned.

DECLASSIFIED

END

**DATE
FILMED**

2 / 27 / 92